# 9th Class 2015

| | | |
|---|---|---|
| Math (Science) | Group-I | Paper- |
| Time: 2.10 Hours | (Subjective Type) | Max. Marks: 6 |

(Part-I)

2. Write short answers to any Six (6) questions: 12

(i) Find |C| : $C = \begin{bmatrix} 3 & 2 \\ 3 & 2 \end{bmatrix}$

**Ans**

$$C = \begin{bmatrix} 3 & 2 \\ 3 & 2 \end{bmatrix}$$

$$|C| = \begin{vmatrix} 3 & 2 \\ 3 & 2 \end{vmatrix}$$

$$|C| = (3)(2) - 3(2)$$

$$|C| = 6 - 6$$

$$|C| = 0$$

(ii) Find the product: $\begin{bmatrix} 1 & 2 \\ -3 & 0 \\ 6 & -1 \end{bmatrix}\begin{bmatrix} 4 & 5 \\ 0 & -4 \end{bmatrix}$

**Ans** $\begin{bmatrix} 1 & 2 \\ -3 & 0 \\ 6 & -1 \end{bmatrix}\begin{bmatrix} 4 & 5 \\ 0 & -4 \end{bmatrix}$

$1^{st}$ matrix has $(3 \times 2)$ order, while $2^{nd}$ matrix has (2 × 2) order. As number of columns of $1^{st}$ matrix is equal to number of rows of $2^{nd}$ matrix, thus product of above matrices will exist. So,

$$\begin{bmatrix} 1 & 2 \\ -3 & 0 \\ 6 & -1 \end{bmatrix}\begin{bmatrix} 4 & 5 \\ 0 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 1(4) + 2(0) & 1(5) + 2(-4) \\ -3(4) + 0(0) & -3(5) + 0(-4) \\ 6(4) + (-1)(0) & 6(5) + (-1)(-4) \end{bmatrix}$$

$$= \begin{bmatrix} 4 + 0 & 5 - 8 \\ -12 + 0 & -15 + 0 \\ 24 + 0 & 30 + 4 \end{bmatrix}$$

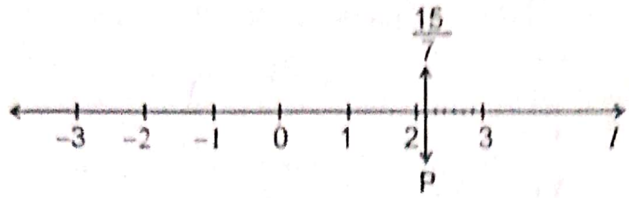
Babulm .Pk

Scanned with CamScanner

$$= \begin{bmatrix} 4 & -3 \\ -12 & -15 \\ 24 & 34 \end{bmatrix}$$

**(iii) Represent the number $\frac{15}{7}$ on the number line.**

**Ans** $\frac{15}{7} = 2\frac{1}{7}$: It lies between 2 and 3.




Divide the distance between 2 and 3 into seven equal parts. The point P represents the number $\frac{15}{7} = 2\frac{1}{7}$.

**(iv) Write the real and imaginary part of the number: 2 + 0i:**

**Ans**

Real part = 2

Imaginary part = 0

**(v) Write into sum or difference: $\log \frac{(22)^{1/3}}{5^3}$**

**Ans**

$$\log \frac{(22)^{1/3}}{5^3}$$

$$= \log (22)^{1/3} - \log (5)^3$$

$$= \frac{1}{3} \log (22) - 3 \log (5)$$

**vi) Write in the form of a single logarithm:**
**$\log 25 - 2 \log 3$**

**Ans**

$$\log 25 - 2 \log 3$$

$$= \log 25 - \log 3^2$$

$$= \frac{\log 25}{\log 3^2} = \log \frac{25}{3^2}$$

**vii) Reduce the algebraic fraction to their lowest form:**

$$\frac{lx + mx - ly - my}{3x^2 - 3y^2}$$

**Ans** $\frac{lx + mx - ly - my}{3x^2 - 3y^2} = \frac{x(l + m) - y(l + m)}{3(x^2 - y^2)}$

Scanned with CamScanner

$$= \frac{(l+m)(x-y)}{3(x+y)(x-y)} \quad \text{(Factorizing)}$$

$$= \frac{l+m}{3(x+y)} \quad \text{(Canceling common factors)}$$

Which is in the lowest form.

**(viii) Evaluate $\frac{x^2y - 2z}{xz}$ for $x = 3, y = -1, z = -2$**

**Ans** By putting the values $x = 3$, $y = -1$, $z = -2$ in th
expression $\frac{x^2y - 2z}{xz}$:

$$= \frac{(3)^2(-1) - (2)(-2)}{(3)(-2)}$$

$$= \frac{9(-1) + 4}{-6}$$

$$= \frac{-9 + 4}{-6}$$

$$= \frac{-5}{-6}$$

$$= \frac{5}{6}$$

باب العلم •Pk BabulIlm

**(ix) Define remainder theorem.**

**Ans** If a polynomial $p(x)$ is divided by a linear divisor $(x-$
then the remainder is $p(a)$.

**3. Write short answers to any Six (6) questions:**

**(i) Find square root of the following $4x^2 - 12x + 9$ by factorizati**

**Ans** Factorization of the expression $4x^2 - 12x + 9$ i
the type: $(a)^2 - 2(a)(b) + (b)^2 = (a - b)^2$

So, $4x^2 - 12x + 9$

$$= (2x)^2 - 2(2x)(3) + (3)^2$$

$$= (2x - 3)^2$$

Taking square root

$$= \pm(2x - 3)$$

**(ii) Solve it: $\sqrt[3]{2x-4} - 2 = 0$**

**Ans**

$$\sqrt[3]{2x-4} = 2$$

Scanned with CamScanner

$$(2x-4)^{1/3}=2$$

By taking cube both sides,

$$[(2x-4)^{1/3}]^3=(2)^3$$

$$2x-4=8$$

$$2x=8+4$$

$$2x=12$$

$$x=\frac{12}{2}$$

$$\boxed{x=6}$$

**(iii) Find the solution set of the equation: $\left|\frac{x+5}{2-x}\right|=6$**

**Ans**

$$\left|\frac{x+5}{2-x}\right|=6$$

$$\pm\left(\frac{x+5}{2-x}\right)=6$$

$$\frac{x+5}{2-x}=6$$

$$x+5=6(2-x)$$

$$x+5=12-6x$$

$$x+6x=12-5$$

$$7x=7$$

$$x=\frac{7}{7}$$

$$\boxed{x=1}$$

$$-\left(\frac{x+5}{2-x}\right)=6$$

$$-(x+5)=6(2-x)$$

$$-x-5=12-6x$$

$$-x+6x=12+5$$

$$5x=17$$

$$\Rightarrow \boxed{x=\frac{17}{5}}$$

So, solution set $=\left\{1,\frac{17}{5}\right\}$.

**(iv) Define Cartesian Plane.**

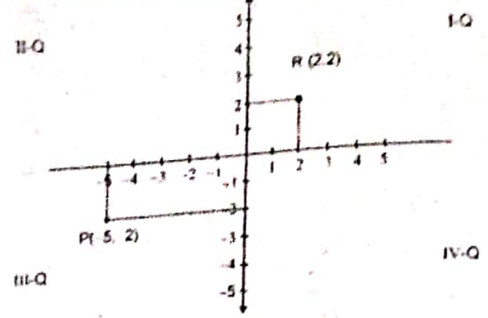
**Ans** The Cartesian plane establishes (one-to-one) correspondence between the set of ordered pairs $R\times R=\{(x,y)\mid x,y\in R\}$ and the points of the Cartesian plane.

**(v) Draw in which quadrant points lie P(–5, –2), R(2, 2).**

**Ans**

| **Ordered Pair** | **Quadrant** |
|---|---|
| P(–5, –2) | III – Q |
| R(2, 2) | I – Q |

Scanned with CamScanner




**(vi) Define equilateral triangle.**

**Ans** If the lengths of all the three sides of a triangle are same, then the triangle is called an equilateral triangle.

**(vii) Find the distance between points**

**$A(-4, \sqrt{2}), B(-4, -3)$**

**Ans** Formula for distance between two points:

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

Here, from question:

$$x_1 = -4 \quad , \quad y_1 = \sqrt{2}$$

$$x_2 = -4 \quad , \quad y_2 = -3$$

By putting, we get:

$$d = \sqrt{[(-4) - (-4)]^2 + [(-3) - \sqrt{2}]^2}$$

$$d = \sqrt{(-4 + 4)^2 + (-3 - \sqrt{2})^2}$$

$$d = \sqrt{0 + [(-1)(3 + \sqrt{2})]^2}$$

$$d = \sqrt{(-1)^2(3 + \sqrt{2})^2}$$

$$d = \sqrt{(3 + \sqrt{2})^2}$$

$$d = 3 + \sqrt{2}$$

**(viii) What do you mean by SAS ≅ SAS?**

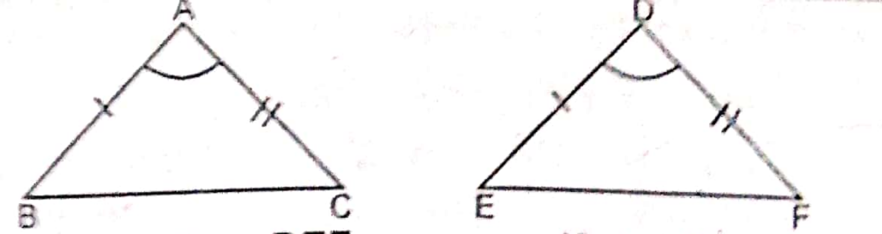
**Ans** In any correspondence of two triangles, if two sides and their included angle of one triangle are congruent to the corresponding two sides and their included angle of the other, then the triangles are congruent.

In $\Delta ABC \longleftrightarrow \Delta DEF$, shown in the following figures,

$$\text{if} \begin{cases} \overline{AB} \cong \overline{DE} \\ \angle A \cong \angle D \\ \overline{AC} \cong \overline{DF} \end{cases}$$

BabulIlm .Pk

Scanned with CamScanner




then $\Delta ABC \cong \Delta DEF$ (S.A.S Postulate)

(ix) **Define parallelogram.**

**Ans** A figure formed by four non-collinear points in the plane is called parallelogram. It characteristics are as under:

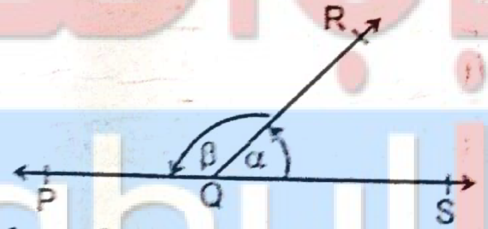
1. Its equal opposite sides are of equal measure.
2. Its opposite sides are parallel.
3. Measure of none of the angle is 90°.

**4. Write short answers to any Six (6) questions: 12**

(i) **Define supplementary angles. Give an example.**

**Ans** Supplementary angles are two angles whose sum is 180°. If the sum of two angles is 180°, then each angle is called the supplement of the other.

For example, in the following figure, $\angle\alpha$ and $\angle\beta$ are supplementary angles.




(ii) **Can a triangle of lengths 2 cm, 4 cm and 7 cm be formed? Give reason.**

**Ans** 2 cm, 4 cm and 7 cm cannot be the sides of a triangles, because $2 + 4 < 7$. The condition for forming a triangle is the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

(iii) **Define proportion.**

**Ans** Equality of two ratios is defined as the proportion.
If $a : b = c : d$, then a, b, c and d are said to be a proportion.

(iv) **Define similar triangles.**

**Ans** Two (or more) triangles are called similar, if they are equiangular and measure of their corresponding sides are proportional. The symbol for similar triangle is (~).

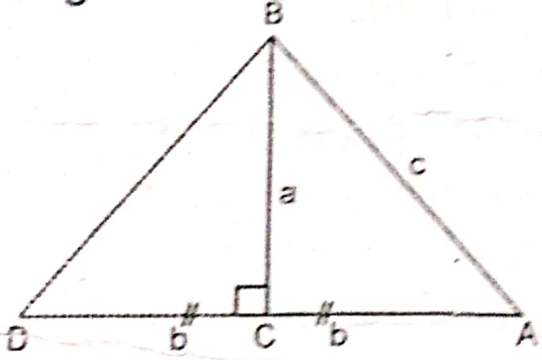
Babullm .Pk

Scanned with CamScanner

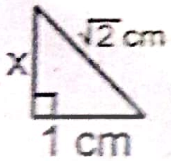
(v) **What is meant by converse of Pythagoras theorem?**

**Ans** Converse of Pythagoras theorem is:

If the square of one side of a triangle is equal to the sum of the squares of the other two sides, then the triangle is a right angled triangle.




(vi) **Find the value of unknown x:**




**Ans** In right angled $\Delta ABC$ is:

$(m\,AC)^2 = (m\,AB)^2 + (m\,BC)^2$ (Pythagoras Theorem)

By putting values:

$$(\sqrt{2})^2 = (x)^2 + (1)^2$$
$$2 = x^2 + 1$$
$$x^2 = 2 - 1$$
$$x^2 = 1$$

By taking square root:

$$\sqrt{x^2} = \sqrt{1}$$
$$x = 1 \text{ cm}$$

(vii) **Define triangular region.**

**Ans** A triangular region is the union of a triangle and its interior, *i.e.*, the three line segments forming the triangle and its interior.

(viii) **Define circumcentre of a triangle.**

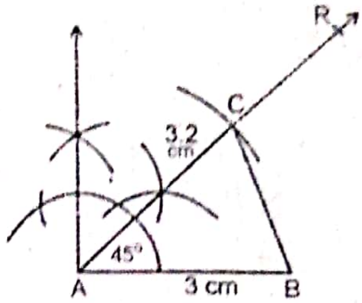
**Ans** The point of concurrency of the perpendicular bisectors of the sides of a triangle is called its circumcentre.

(ix) **Construct $\Delta$ ABC, in which : m $\overline{AB}$ = 3 cm, m $\overline{AC}$ = 3 cm, m$\angle$ A = 45°**

BabulIlm .Pk

Scanned with CamScanner

**Ans**




**Steps of Construction:**

) Take a line segment $\overline{AB} = 3$ cm.

i) Make an angle of $45^o$ at A.

ii) Take A as centre and cut off $\overline{AC} = 3.2$ cm on $\overrightarrow{AR}$.

v) Join C to B.

(v) ABC is the required triangle.

**(Part-II)**

**IOTE: Attempt Three (3) questions in all. But question No. 9 is Compulsory.**

**Q.5.(a) Solve with help of Cramer's rule:** **(4)**

$$4x + 2y = 8$$

$$3x - y = -1$$

**Ans** Write the equations in matrix form

$$\begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ -1 \end{bmatrix}$$

Let, $AX = B$

Where,

$$A = \begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 8 \\ -1 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 4 & 2 \\ 3 & -1 \end{vmatrix}$$

$$|A| = (4)(-1) - (2)(3)$$

$$|A| = -4 - 6$$

$$\boxed{|A| = -10}$$

$$|A| = \begin{vmatrix} 8 & 2 \\ -1 & -1 \end{vmatrix}$$

Scanned with CamScanner

$$|A_x| = (8)(-1) - (-1)(2)$$

$$|A_x| = -8 + 2$$

$$\boxed{|A_x| = -6}$$

$$|A_y| = \begin{vmatrix} 4 & 8 \\ 3 & -1 \end{vmatrix}$$

$$|A_y| = (4)(-1) - (3)(8)$$

$$|A_y| = -4 - 24$$

$$\boxed{|A_y| = -28}$$

So, $x = \dfrac{|A_x|}{|A|} = \dfrac{-6}{-10} = \dfrac{3}{5}$

$y = \dfrac{|A_y|}{|A|} = \dfrac{-28}{-10} = \dfrac{14}{5}$

Solution Set $= \left[\dfrac{3}{5}, \dfrac{14}{5}\right]$

**(b) Solve the equation for real x and y**

$(3 + 4i)^2 - 2(x - yi) = x + yi$

**Ans** 24 $(12)^2$ 12

$$(3 + 4i)^2 - 2(x - yi) = x + yi$$

$$9 + 24i + 16i^2 - 2x - 2yi = x + yi$$

$$9 + 24i + 16(-1) - 2x + 2yi = x + yi$$

$$9 + 24i - 16 - 2x - x + 2yi - yi = 0$$

$$9 + 24i - 16 - 3x + yi = 0$$

$$-3x + yi = 16 - 9 - 24i$$

$$-3x + yi = 7 - 24i$$

By comparing w.r.t $a + bi$ form:

$$-3x = 7 \quad \ldots (i)$$

and

$$y = -24 \quad \ldots (ii)$$

from (i) $-3x = 7$

$$x = \frac{-7}{3}$$

$\therefore$ $\boxed{x = \dfrac{-7}{3}}$, $\boxed{y = -24}$

Babulilm

Scanned with CamScanner

**Q.6.(a) Use log tables to find the value of:** (4)

$$\frac{(438)^3\sqrt{0.056}}{(388)^4}$$

**Ans** Let $x = \frac{(438)^3\sqrt{0.056}}{(388)^4}$

$$x = \frac{(438)^3(0.056)^{1/2}}{(388)^4}$$

By taking log, both sides:

$$\log x = \log\left[\frac{(438)^3(0.056)^{1/2}}{(388)^4}\right]$$

$$\log x = 3\log 438 + \frac{1}{2}\log 0.056 - 4\log 388$$

$$\log x = 3(2.6415) + \frac{1}{2}(\bar{2}.7482) - 4(2.5888)$$

$$\log x = 7.9245 + \bar{1}.3741 - 10.3552$$

$$\log x = 7.9245 - 1 + 0.3741 - 10.3552$$

$$\log x = -3.0566$$

$$\log x = -3.0566 - 1 + 1$$

$$\log x = \bar{4}.9434$$

Taking antilog both sides,

$$x = \text{Antilog}(\bar{4}.9434)$$

$$\boxed{x = 0.0008778}$$

**(b) Simplify:** $\frac{\sqrt{a^2+2}+\sqrt{a^2-2}}{\sqrt{a^2+2}-\sqrt{a^2-2}}$ (4)

**Ans** With Rationalization:

$$= \frac{\sqrt{a^2+2}+\sqrt{a^2-2}}{\sqrt{a^2+2}-\sqrt{a^2-2}} \times \frac{\sqrt{a^2+2}+\sqrt{a^2-2}}{\sqrt{a^2+2}+\sqrt{a^2-2}}$$

$$= \frac{(\sqrt{a^2+2}+\sqrt{a^2-2})^2}{(\sqrt{a^2+2})^2-(\sqrt{a^2-2})^2}$$

$$= \frac{(\sqrt{a^2+2})^2+(\sqrt{a^2-2})^2+2(\sqrt{a^2+2})(\sqrt{a^2-2})}{(a^2+2)-(a^2-2)}$$

Scanned with CamScanner

$$= \frac{(a^2+2)+(a^2-2)+2\sqrt{(a^2+2)(a^2-2)}}{a^2+2-a^2+2}$$

$$= \frac{a^2+2+a^2-2+2\sqrt{(a^2)^2-(2)^2}}{4}$$

$$= \frac{2a^2+2\sqrt{a^4-4}}{4}$$

$$= \frac{2(a^2+\sqrt{a^4-4})}{4}$$

$$= \frac{a^2+\sqrt{a^4-4}}{2}$$

**Q.7.(a) Factorize: $2x^3 + x^2 - 2x - 1$**

**Ans** We have; $P(x) = 2x^3 + x^2 - 2x - 1$

The possible factors of the constant term

$P = -1$ are $\pm 1, \pm \frac{1}{2}$.

From factors of the constant

Let, $x = -1$

$$\begin{aligned} P(-1) &= 2(-1)^3 + (-1)^2 - 2(-1) - 1 \\ &= 2(-1) + 1 + 2 - 1 \\ &= -2 + 3 - 1 \\ &= 0 \end{aligned}$$

Hence, $x = -1$ is a zero of $P(x)$;

As,

$$\begin{aligned} x - a &= 0 \\ x - (-1) &= 0 \\ x + 1 &= 0 \end{aligned}$$

So, $x + 1$ is the 1st factor of $P(x)$.

Similarly,

Let $x = 1$

$$\begin{aligned} P(1) &= 2(1)^3 + (1)^2 - 2(1) - 1 \\ &= 2(1) + 1 - 2 - 1 \\ &= 2 + 1 - 2 - 1 \\ &= 0 \end{aligned}$$

Hence, $x = 1$ is a zero of $P(x)$;

As, $x - a = 0$

Scanned with CamScanner

$$x - 1 = 0$$

So, $x - 1$ is the $2^{nd}$ factor of P(x).

Again;

Let $x = \frac{-1}{2}$

$$P(\tfrac{-1}{2}) = 2(\tfrac{-1}{2})^3 + (\tfrac{-1}{2})^2 - 2(\tfrac{-1}{2}) - 1$$

$$= 2(\tfrac{-1}{8}) + (\tfrac{1}{4}) + 1 - 1$$

$$= \frac{-1}{4} + \frac{1}{4} + 0$$

$$= 0$$

Hence, $x = \frac{-1}{2}$ is a zero of P(x)

As, $x - a = 0$

$$x - (\tfrac{-1}{2}) = 0$$

$$x + \frac{1}{2} = 0$$

$$(2)(x) + (2)(\tfrac{1}{2}) = (0)(2)$$

$$2x + 1 = 0$$

So, $2x + 1$ is the last factor of P(x). As from the expression, there exist maximum three factors, *i.e.*,

The factors of P(x) are $= (x - 1)(x + 1)(2x + 1)$

**(b) Find the H.C.F of the following polynomials: (4)**

**$x^2 - 4,\ x^2 + 4x + 4,\ 2x^2 + x - 6$**

**Ans** By factorization:

$$x^2 - 4 = (x + 2)(x - 2)$$

$$x^2 + 4x + 4 = (x + 2)^2 = (x + 2)(x + 2)$$

$$2x^2 + x - 6 = 2x^2 + 4x - 3x - 6$$

$$= 2x(x + 2) - 3(x + 2)$$

$$= (x + 2)(2x - 3)$$

Hence, H.C.F $= x + 2$

Scanned with CamScanner

**Q.8.(a) Find the solution set of the equation:**

$$|8x - 3| = |4x + 5|$$

$$8x - 3 = \pm(4x + 5)$$

**Ans** Since two numbers having the same absolute value are either equal or differ in sign, therefore, the given equation is equivalent to

$$8x - 3 = 4x + 5$$
$$8x - 4x = 5 + 3$$
$$4x = 8$$
$$\boxed{x = 2}$$

$$8x - 3 = -(4x + 5)$$
$$8x - 3 = -4x - 5$$
$$8x + 4x = -5 + 3$$
$$12x = -2$$
$$\boxed{x = \frac{-1}{6}}$$

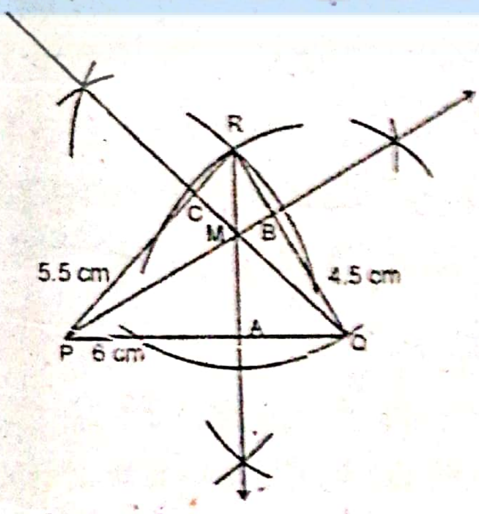
On checking, we find that $x = 2$, $x = \frac{-1}{6}$ both satisfy the original equation.

Hence the solution set $= \left\{\frac{-1}{6}, 2\right\}$.

**(b) Construct $\Delta PQR$, draw its altitudes and show that they are concurrent:** (4)

$m\overline{PQ} = 6$ cm, $m\overline{QR} = 4.5$ cm and $m\overline{PR} = 5.5$ cm

**Ans**




## Steps of Construction:

(i) Take a line segment $\overline{PQ} = 6$ cm.

(ii) Take P as centre and draw an arc of 5.5 radius.

(iii) Take Q as centre and draw an arc of 4.5 radius.

Scanned with CamScanner

iv) Join R to P and Q.

$\because$ PQR is the required triangle.

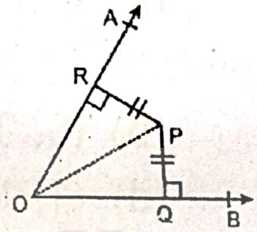
v) Drop $\overline{RA}$, $\overline{PB}$ and $\overline{QC}$ perpendiculars to $\overline{PQ}$, $\overline{QR}$ and $\overline{RP}$, respectively.

$\overline{RA}$, $\overline{PB}$ and $\overline{QC}$ are concurrent at M.

**Q.9. Prove that any point inside an angle, equidistant from its arms, is on the bisector of it. (8)**

**Ans** **Given:**

Any point P lies inside $\angle AOB$ such that $\overline{PQ} \cong \overline{PR}$, where $\overline{PQ} \perp \overline{OB}$ and $\overline{PR} \perp \overline{OA}$.




**To Prove:**

Point P is on the bisector of $\angle AOB$.

**Construction:**

Join P to O.

**Proof:**

| Statements | Reasons |
|---|---|
| In $\Delta POQ \leftrightarrow \Delta POR$ | |
| $\angle PQO \cong \angle PRO$ | given (right angles) |
| $\overline{PO} \cong \overline{PO}$ | common |
| $\overline{PQ} \cong \overline{PR}$ | given |
| $\therefore$ $\Delta POQ \cong \Delta POR$ | H.S $\cong$ H.S |
| Hence, $\angle POQ \cong \angle POR$ | (corresponding angles of congruent triangles) |
| *i.e.,* P is on the bisector of $\angle AOB$. | |

**OR**

**Prove that triangles on the same base and of the same (*i.e.,* equal) altitudes are equal in area.**

**Ans** For Answer see Paper 2014 (Group-I), Q.9.(OR).

Scanned with CamScanner